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by Gonzalez

jc542 U.S. PTO

09/258442



02/26/99

SIR:

Transmitted herewith for filing is: ☒ a new application☐ a c-i-p application of S.N. \_\_\_\_\_ filed \_\_\_\_\_

Inventor(s): Syuji TAKADA; Yasuhiro OOBA

For: COMMON BUFFER MEMORY CONTROL APPARATUS

Enclosed are:

☒ 3 sheets of drawings. (Figs. 1-3)☒ Specification, including claims and abstract (17 pages)☒ Declaration☒ An assignment of the Invention to FUJITSU LIMITED☒ A certified copy of Japanese Application No. 10-062530☒ An associate power of attorney☐ A verified statement to establish small entity status under 37 CFR 1.9 and 37 CFR 1.27☒ Post card☒ Recording fee (as indicated below)☒ Information Disclosure Statement, PTO-1449, copies of 1 references☐ Other \_\_\_\_\_☐ Other \_\_\_\_\_

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FOR:	NO. FILED	NO. EXTRA
BASIC FEE		
TOTAL CLAIMS	11 - 20 =	0
INDEP CLAIMS	1 - 3 =	0
<input type="checkbox"/> MULTIPLE DEPENDENT CLAIMS PRESENTED		

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RATE	FEE
	\$380
x 9 =	\$
x 39 =	\$
x 130 =	\$
TOTAL	\$

OTHER THAN A SMALL ENTITY	
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x 18 =	\$
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SPECIFICATION

TO ALL WHOM IT MAY CONCERN:

BE IT KNOWN THAT WE, Syuji Takada, a citizen of Japan residing at Kawasaki-shi, Kanagawa, Japan and Yasuhiro Ooba, a citizen of Japan residing at Kawasaki-shi, Kanagawa, Japan have invented certain new and useful improvements in

COMMON BUFFER MEMORY CONTROL APPARATUS

of which the following is a specification : -

TITLE OF THE INVENTION

COMMON BUFFER MEMORY CONTROL APPARATUS

BACKGROUND OF THE INVENTION

5 1. Field of the Invention

The present invention relates to a common buffer memory control apparatus such as an ATM switching system, and more particularly to a common buffer memory control apparatus applied to a message communication service in which message data formed of a plurality of cells is transmitted.

2. Description of the Related Art

10 An ATM switching system operated in an Asynchronous Transfer Mode is used in a broad-band integrated services digital network (B-ISDN). In such an ATM switching system, a switching apparatus using a common buffer memory carries out a routing operation for cells in an ATM network.

20 A conventional switching apparatus using the common buffer memory controls, using address chains, a read/write operation of the common buffer memory. Fig. 1 shows a conventional switching apparatus using the common buffer memory.

Referring to Fig. 1, the switching apparatus has a multiplexing unit (MUX) 31, a common buffer memory 32, an address pointer 33, a demultiplexing unit (DEMUX) 34, a routing information decoder (RTGDEC) 35, a writing address memory 36, a reading address memory 37, an output route number decoder 38 and an output route number counter 39. The address pointer 33 specifies reading and writing points in the common buffer memory 32.

35 The writing address memory 36 has memory areas WA-1 to WA-n each of which corresponds to one of output routes. The reading address memory 37 has memory areas RA-1 to RA-n each of which corresponds

to one of the output routes.

Cells input from respective input lines (input-1~input-n) are multiplexed by the multiplexing unit 33 and output to the common buffer memory 32 cell by cell. The multiplexing unit 31 extracts routing information stored in a header portion of each cell. The routing information is then supplied to the routing information decoder 35. The routing information decoder 35 decodes the routing information and specifies a writing address memory area WA-i corresponding to an output route number i obtained by decoding the routing information.

The respective writing address memory areas WA-1~WA-n, corresponding to the output routes, stores writing addresses for cells in the common buffer memory 32. The writing address memory area WA-i specified by the routing information decoder 35 outputs a writing address stored therein to the address pointer 33.

The common buffer memory 32 stores a cell received from the multiplexing unit 31 at an address specified by the address pointer 33. In addition, when the next cell for the same output route is received, the address pointer 33 outputs an address at which the cell should be stored to the writing address memory area WA-i so that the contents of the writing address memory area WA-i is updated to the new address.

On the other hand, the cell written in the common buffer memory 32 is read out therefrom as follows. The output route number counter 39 successively outputs output route numbers in order. The output route number decoder 38 specifies a read address memory area RA-i corresponding to an output route number i.

The respective read address memory areas

RA-1 to RA-n corresponding to the output routes store addresses of the common buffer memory 32 at which cells to be transmitted are stored. The read address memory area RA-i specified by the output  
5 route decoder 38 outputs an address stored therein to the address pointer 33. A cell stored at the address specified by the address pointer 33 is read out from the common buffer memory 32 and supplied to the demultiplexing unit 34.

10 In addition, the address pointer 33 outputs an address at which a cell to be next transmitted to the output route has been stored to the read address memory area RA-i. The contents of the read address memory area RA-i is thus updated to  
15 the new address.

When the cell is read out from the common buffer memory 32 and output to the demultiplexing unit 34, the area (address) of the common buffer memory 32 in (at) which the cell has been stored is  
20 opened. After this, the area of the common buffer memory 32 is used to write a cell received later.

The cells read out from the common buffer memory 32 are routed to output routes, by the demultiplexing unit 34, in accordance with routing  
25 information in the header portions of the cells. The cell are then output to corresponding output lines (output-1~output-n).

When the so-called message communication service in which a single message data item formed  
30 of a plurality of cells is transmitted is supported by using a such conventional switching apparatus as described above, the single message data item is stored in the common buffer memory 32 so as to be divided in to a plurality of cells.

35 Thus, in handling of the message data between the ATM layer and the upper layer, all addresses at which the respective cells of the

single message data item should be processed. As a result, the process is complex and the quick supply of the message communication service deteriorates.

5 SUMMARY OF THE INVENTION

Accordingly, a general object of the present invention is to provide a novel and useful common buffer memory control apparatus in which the disadvantages of the aforementioned prior art are  
10 eliminated.

A specific object of the present invention is to provide a common buffer memory control apparatus in which the address control to process a single message data item formed of a plurality of  
15 cells can be simplified to be capable of quick message communication service.

The above objects of the present invention are achieved by a common buffer memory control apparatus controlling a common buffer memory which  
20 is used to store message data items each of which is divided into a plurality of cells based on an asynchronous transfer mode, said apparatus comprising: first management means for managing whether each of blocks into which said common buffer  
25 memory divided is free or used; block selecting means for selecting a block of said common buffer memory which is free based on information obtained by said first management means; and cell writing control means for controlling a write operation for  
30 a single message data item so that the respective cells of the single message data item are written in the block, selected by said block selecting means, of said common buffer memory.

According to the present invention, the  
35 write operation for a single message data item so that the single message data item is written in the same block of the common buffer memory. Thus, a

reading control operation for cells of each of  
message data items can be simplified. In addition,  
the handling operation of the message data between  
the ATM layer and the upper layer can be rapidly and  
5 easily executed.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Other objects, features and advantages of  
the present invention will be apparent from the  
10 following description when read in conjunction with  
the accompanying drawings, in which:

Fig. 1 is a block diagram illustrating a  
conventional switching apparatus using a common  
buffer memory;

15 Fig. 2 is a block diagram illustrating a  
switching apparatus, using a common buffer memory,  
according to an embodiment of the present invention;  
and

Fig. 3 is a flowchart illustrating a  
20 procedure of a control process for the common buffer  
memory.

#### DESCRIPTION OF THE PREFERRED EMBODIMENTS

A description will be given of a common  
25 buffer memory control apparatus according to an  
embodiment of the present invention.

A switching apparatus, using a common  
buffer memory, according to an embodiment of the  
present invention is formed as shown in Fig. 2.  
30 Referring to Fig. 2, input lines 10-#1 to 10-#n are  
provided to the switching apparatus. The switching  
apparatus has a multiplexing unit 11, a cell  
determination unit 12, a common buffer memory 13, an  
address pointer 14, a message queue 15, a  
35 demultiplexing unit 16 and a common buffer memory  
control apparatus 20. The switching apparatus is  
connected with lines 17-#1 to 17-#n. The common

buffer memory control apparatus 20 has a free block  
searching unit 21, a free block management table 22,  
a block management table 23, a user management table  
24 and an address management table 25. An external  
5 input/output device 30 is coupled to the common  
buffer memory control apparatus 20.

The common buffer memory 13 is divided  
into blocks BLK-1 to BLK-n each of which is  
controlled to read and write cells.

10 The free block management table 22 areas  
22-1 to 22-n each of which corresponds to one of the  
blocks BLK-1 to BLK-n of the common buffer memory 13.  
Each of the areas 22-1 to 22-n is used to store  
state information indicating whether a corresponding  
15 block of the common buffer memory 13 is free or used.  
The block management table 23 has areas 23-1 to 23-n  
each of which corresponds to one of the blocks BLK-1  
to BLK-n. The areas 23-1 to 23-n stores write  
addresses. The user management table 24 has areas  
20 24-1 to 24-n used to store identification numbers of  
users. The address management table 25 has areas  
25-1 to 25-n each of which corresponds to one of the  
blocks BLK-1 to BLK-n. The areas 25-1 to 25-n are  
used to store last write addresses.

25 The common buffer memory 13 is controlled  
in accordance with a procedure as shown in Fig. 3.

Cells received through the input lines 10-  
#1~10-#n are multiplexed by the multiplexing unit  
11 and successively supplied to the cell  
30 determination unit 12 one by one. The cell  
determination unit 12 determines, based on  
additional information in a cell, whether the cell  
is a cell at the head of message data, a cell in a  
mid-portion of the message data or a cell at the  
35 tail of the message data (see S1-1 and S1-2 in Fig.  
3). If it is determined that the received cell is  
the cell of the head of the message data, the cell



determination unit 12 outputs to the free block searching unit 21 a signal indicating that the cell of the head of the message data has been received.

The free block searching unit 21 searches  
5 the areas 22-1 to 22-n of the free block management table 22 for an area storing the state information indicating that a corresponding block is free in order to select a block BLK-i of the common buffer memory 13 which is free, when receiving the signal  
10 indicating that the cell of the head of the message data has been received. Hereinafter, the block of the common buffer 13 which is free is referred to as a free block. When the free block is detected, the free block searching unit 21 changes the state  
15 information in the area 22-i, corresponding to the block BLK-i of the common buffer memory 13, of the free block management table 22 from "FREE" to "USED" (see S2 in Fig. 3).

The free block searching unit 21 then  
20 selects an area 23-i and an area 24-i, corresponding to the detected block BLK-i of the common buffer memory 13, of the block management table 23 and the user management table 24. The selected area 23-i of the block management table 23 obtains a head address  
25 of the block BLK-i based on an address stored in an area 25-i, corresponding to the selected area 23-i of the block management table 23, of the address management table 25 (see S3 in Fig. 3). The cell determination unit 21 updates the contents of the  
30 selected area 24-i of the user management table 24 based on a user identification number extracted from the received cell (see S4 in Fig. 3).

The area 23-i of the block management table 23 outputs the head address of the block BLK-i  
35 of the common buffer memory 13 to the address pointer 14. The address pointer 14 specifies a write address using the address supplied from the

area 23-i of the block management table 23. The cell supplied through the cell determination unit 12 is stored at the write address of the common buffer memory 13 (see S5 in Fig. 3).

5                   In addition, the address pointer 14 outputs a write address at which the next received cell should be written to the area 25-i of the address management table 25. The area 25-i of the address management table 25 stores the new address  
10 as a last write address (see in Fig. 3).

                  If it is determined that a received cell is the cell in the mid-portion of the message data, a user identification number is extracted from information in the received cell. With reference to  
15 the area 25-i of the address management table 25 corresponding to an area 24-i of the user management table in which the extracted user identification number is stored, the last write address stored in the area 25-i of the address management table 25 is  
20 supplied to the area 23-i of the block management table 23 (see S7 in Fig. 3). When the area 23-i of the block management table 23 receives the last write address, the write operation using the address pointer 14 is performed in the same manner as in the  
25 above case. The received cell is thus stored in the block BLK-i of the common buffer memory 13. After the cell is written in the common buffer memory 13, the last write address in the area 25-i of the address management table 25 is updated (see S6 in  
30 Fig. 3). While cells in the mid-portion of the message data are being received, the above operation is repeatedly executed.

                  If it is determined that a received cell is the cell at the tail of the message data, the  
35 block BLK-i of the common buffer memory 13 in which the message data is stored is detected with reference to the user management table 24. All the

contents of the block BLK-i are stored in the message queue 15 (see S8 in Fig. 3). The block BLK-i is opened so as to be free. The state information of the area 22-i, corresponding to the block BLK-i  
5 of the common buffer memory 13, of the free block management table 22 is changed to "FREE" indicating that the block is free (see S9 in Fig. 3). As a result, the block BLK-i of the common buffer memory 13 can be used for other message data after this.

10 The operation described above is executed in a case where there is neither lost cells nor erroneously inserted cells. Even if the head or tail of the message data is out of order caused by the loss cells and/or the erroneously inserted cells,  
15 the address control is simplified as cells of a single message data item are stored together in a single block of the common buffer memory 13. As a result, the handling operation for the message data between the ATM layer and the upper layer can be  
20 quickly and easily executed.

Thus, when the message data read out from the common buffer memory 13 is written in the message queue 15, various types of controls can be executed in accordance with abnormality of the  
25 message data. The message data may be overwritten in the message queue 15. The message data may be canceled and an error message and a retransmission request may be returned to the sender. The message data may be written in the message queue 15 and  
30 processed for protection. That is, processes suitable for the abnormality of the message data can be easily executed, so that the quality of the service can be improved.

In the above embodiment, after the cell at  
35 the head of the message data is received, the free block searching unit 21 searches for a free block of the common buffer memory 13. The free block

searching unit 21 may search for a free block of the common buffer memory 13 before the cell at the head of the message data is received. In this case, cell can be further quickly written in the common buffer memory 13.

In addition, the number of blocks BLK-1~BLK-n of the common buffer memory 13 and the length of each of the blocks may be fixed. However, they may be also controlled based on traffic state information supplied from the external input/output device 30. In this case, the memory area of the common buffer memory 13 can be efficiently used.

Further, the common buffer memory 13 may be divided into a plurality of block groups each of which includes a plurality of blocks. Blocks of the same block group have the same length. Blocks of different block groups have different lengths. An address at which the cell at head of the message data should be stored is assigned to each block. Each of the block groups is independently searched for a free block. In this case, the memory area of the common buffer memory 13 can be efficiently used and the memory can be quickly accessed.

The cell determination unit 12 may controls the length of each block of the common buffer memory 13 based on information about the amount of message data extracted from a cell transmitted at the start of the message communication. In this case, if the amount of message data actually received is less than the length of the block controlled as described above, the remaining area of the block is opened so as to be capable of being used in the following message communication. The message management efficiently using resources can be executed. In a case where cells in the mid-portion of the message data are received, in a case where the cell at the head of

message data is received before the cell at the tail  
of message data is received, and in a case where  
message data is abnormal so that a predetermined  
cell is not received after elapsing a predetermined  
5 time period, it may be determined that the amount of  
message data of cell actually received is less than  
the length of the block controlled as described  
above.

The present invention is not limited to  
10 the aforementioned embodiments, and other variations  
and modifications may be made without departing from  
the scope of the claimed invention.

The present invention is based on Japanese  
priority application No.10-062530 filed on March 13,  
15 1998, the entire contents of which are hereby  
incorporated by reference.

WHAT IS CLAIMED IS:

5

1. A common buffer memory control apparatus controlling a common buffer memory which is used to store message data items each of which is divided into a plurality of cells based on an asynchronous transfer mode, said apparatus comprising:

first management means for managing whether each of blocks into which said common buffer memory divided is free or used;

15 block selecting means for selecting a block of said common buffer memory which is free based on information obtained by said first management means; and

20 cell writing control means for controlling a write operation for a single message data item so that the respective cells of the single message data item are written in the block, selected by said block selecting means, of said common buffer memory.

25

2. The common buffer memory control apparatus as claimed in claim 1, wherein said first management means comprises:

30 a free block management table having areas each of which corresponds to one of the blocks of said common buffer memory, each of the areas of said free block management table storing information  
35 indicating whether a corresponding one of the blocks of said common buffer memory is free or used, wherein said block selecting means selects, with

reference to said free block management table, the block which is free.

5

3. The common buffer memory control apparatus as claimed in claim 2, wherein said block selecting means comprises:

10 free block searching means for searching said free block management table for an area storing the information indicating that a corresponding block is free, wherein the block corresponding to the area obtained by said free block searching means  
15 is selected.

20 4. The common buffer memory control apparatus as claimed in claim 1, wherein said cell writing control means comprises:

second management means for managing addresses in each of the blocks of said common  
25 buffer memory; and

address specifying means for specifying, based on information obtained by said second management means, an address in the block selected by said block selecting means every time one of  
30 cells of the single message data item is received, so that the cells of the single message data item are written at addresses specified by said address specifying means.

35

5. The common buffer memory control apparatus as claimed in claim 4, wherein second management means comprises:

a table having areas each of which  
5 corresponds to one of the blocks of said common buffer memory, each of the areas storing an address at which the next cell should be written, the address in each of the areas of said table being updated every time a cell is written in a  
10 corresponding block of said common buffer memory.

15 6. The common buffer memory control apparatus as claimed in claim 1, wherein a number of blocks of said common buffer memory and a length of each of the blocks are set at values corresponding to data supplied from an external input device.

20

7. The common buffer memory control  
25 apparatus as claimed in claim 1, wherein a length of each of the blocks of said common buffer memory is controlled based on information about an amount of information of the message data extracted from a cell.

30

8. The common buffer memory control  
35 apparatus as claimed in claim 7, wherein, if the amount of information of the message data actually written in the block is less than the controlled



length of the block, a remaining area of the block is opened so as to be used in following message communication.

5

9. The common buffer memory control apparatus as claimed in claim 1 further comprising:  
10 user management means for managing the blocks of said common buffer memory so that a block storing a head cell positioned at a head of the message data corresponds to user identification information extracted from the head cell, wherein  
15 said cell writing control means controls, based on information obtained by said user management means, the write operation so that each of cells positioned in a mid-portion of the message data is written in the block corresponding to user identification  
20 information extracted from said each of the cells.

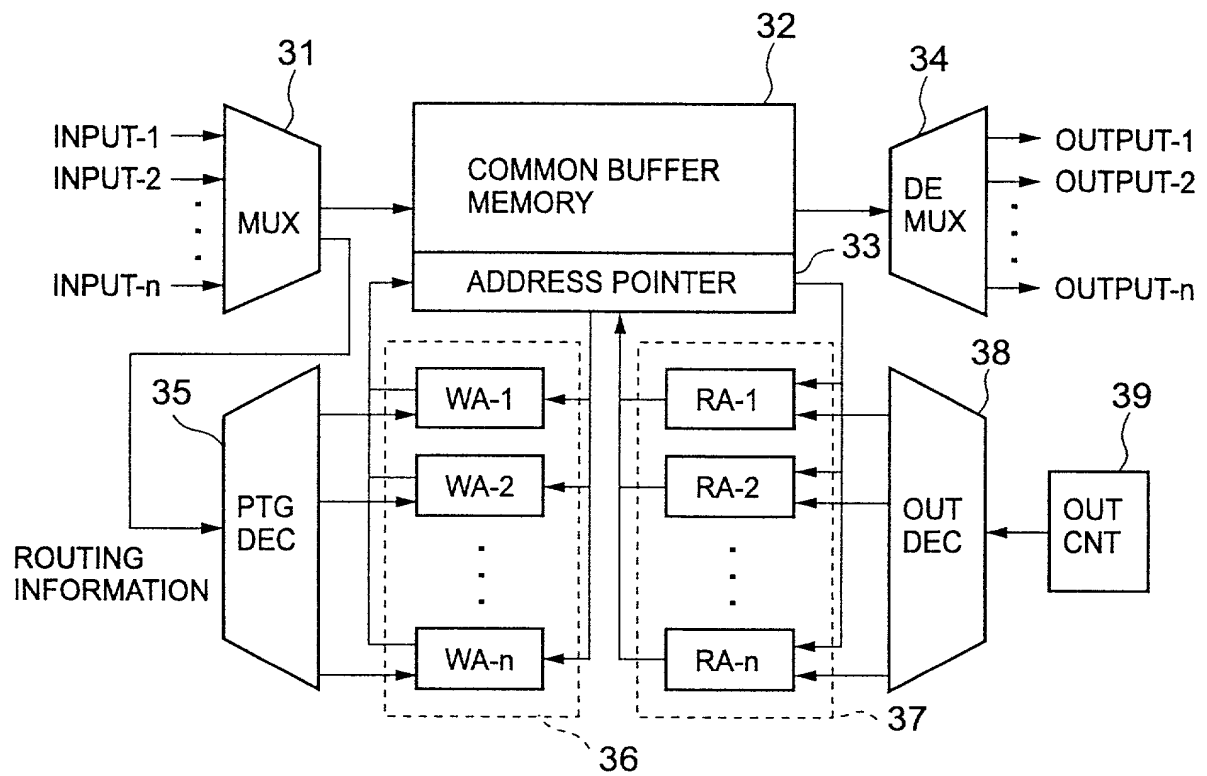
25 10. The common buffer memory control apparatus as claimed in claim 9, wherein said user management means comprises:  
a user management table having areas each of which corresponds to one of the blocks of said  
30 common buffer, each of the areas storing the user identification information extracted from the head cell which has been written in a corresponding block of said common buffer memory, wherein said cell writing control means controls the write operation  
35 with reference to said user management table.

11. The common buffer memory control  
apparatus as claimed in claim 1, wherein said block  
selecting means selects a block of said common  
buffer memory which is free in advance of receiving  
5 a head cell positioned at a head of the message data.

5  
10  
15

20

FIG.1



# FIG.2

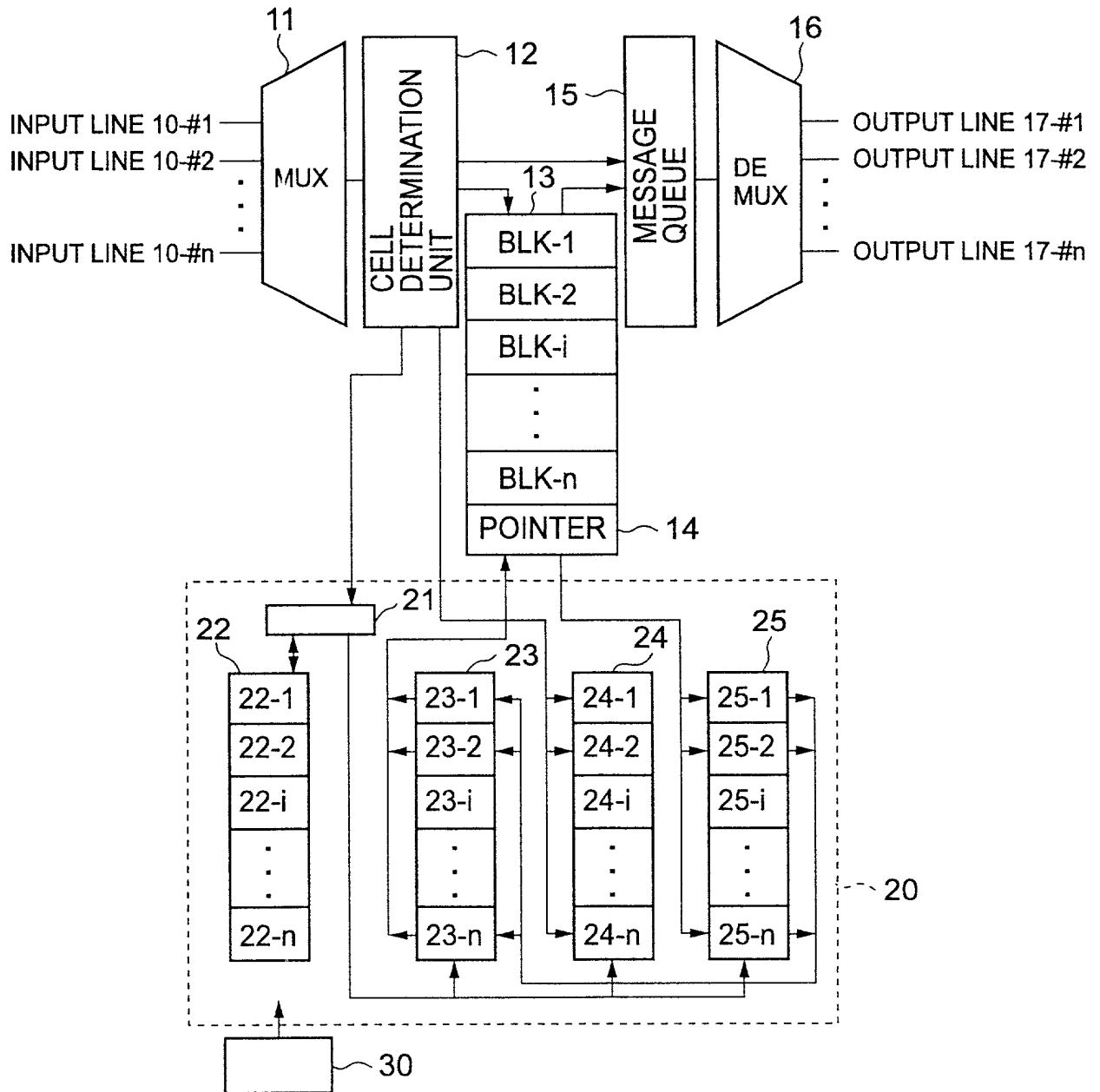
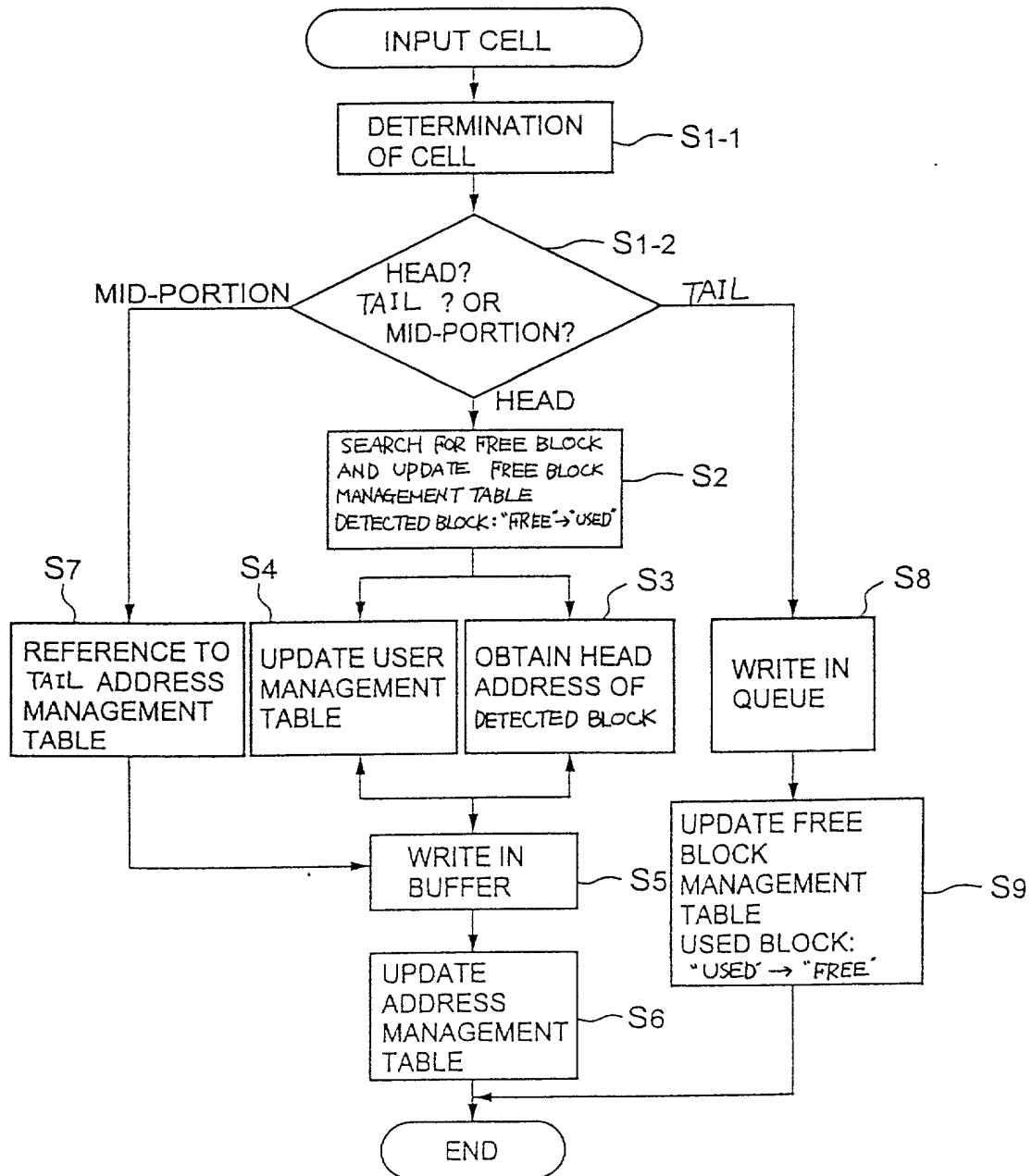


FIG.3



DECLARATION FOR PATENT APPLICATION Docket No. FUJI 15.894

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled COMMON BUFFER MEMORY CONTROL APPARATUS

The specification of which

(check one) ☒ is attached hereto.

☐ was filed on \_\_\_\_\_ as

Application Serial No. \_\_\_\_\_

and was amended on \_\_\_\_\_ (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by an amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Prior Foreign Application(s)			Priority Claimed
Pat. Appln. No. <u>10-062530</u>	<u>Japan</u>	<u>13/March/1998</u>	<input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> No
(Number)	(Country)	(Day/Month/Year Filed)	
(Number)	(Country)	(Day/Month/Year Filed)	Yes No
(Number)	(Country)	(Day/Month/Year Filed)	Yes No

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

(Application Serial No.)	(Filing Date)	(Status - patented, pending, abandoned)
(Application Serial No.)	(Filing Date)	(Status - patented, pending, abandoned)

I hereby appoint as my attorney and agent Aaron B. Karas, Reg. No. 18,923, Samson Helfgott, Reg. No. 23,072, Leonard Cooper Reg. No. 27,625 and Emma Shleifer, Reg. No. 29,734 to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith:

Address all correspondence to:

HELFGOTT & KARAS P.C.  
60th Floor  
Empire State Building  
New York, New York 10118 0110  
Telephone No. (212) 643-5000

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Full name of sole or first inventor Syuji Takada

Inventor's signature Syuji Takada Date February 12, 1999

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Full name of second joint inventor, if any Yasuhiro Ooba

Second Inventor's signature Yasuhiro Ooba Date February 12, 1999

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THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of: Syuji TAKADA et al.

Filed: : Concurrently herewith

For : COMMON BUFFER MEMORY CONTROL APPARATUS

Serial No.: Concurrently herewith

February 26, 1999

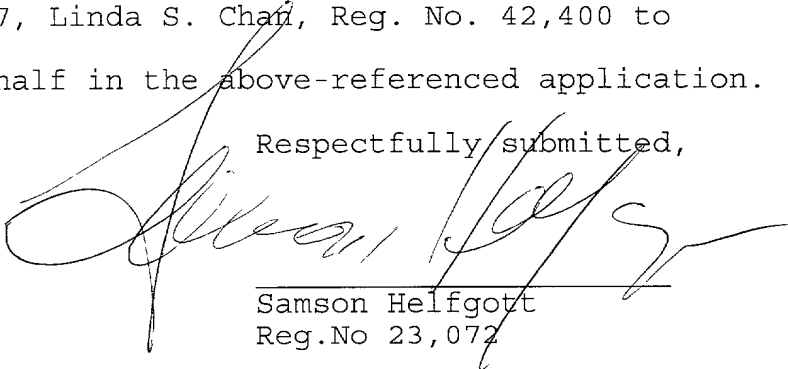
Assistant Commissioner of Patents  
Washington, D.C. 20231

SUB-POWER OF ATTORNEY

S I R:

I, Samson Helfgott Reg. No. 23,072 attorney of record  
herein, do hereby grant a sub-power of attorney to Russell  
Gross, Reg. No. 40,007, Linda S. Chan, Reg. No. 42,400 to  
act and sign in my behalf in the above-referenced application.

Respectfully submitted,



Samson Helfgott  
Reg.No 23,072

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